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Integrative Performance of the House and the Low-Cost for the Respondent to the Hot Humid Climate

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Abstract: ***The study deals with the achievement of climate efficiency and makes the housing more suitable for the climate in the humid areas, including the city of Basra, because most exposed to solar radiation ceiling. The study provides an alternative architecture and simplified manner in the implementation of the ceiling manner (jack arching) Using light concrete blocks (Althermiston) with iron I-Section or joists concrete pre-processing, the study aims to provide extracted data from comparisons based on detailed accounts of a number of alternatives structural variables and design to help designers to approach in their designs of climate appropriate and minimize the total cost of the house. Comparative study analytical method based building model Default prevailing residence in the city of Basra and test study indicators with one computer energy simulation programs (Ecotect) for a number of building envelope components variables, guidance, as convergence, vents and comparing the performance of the model basis for drawing optimal design parameters. The results showed that the use of light concrete blocks for the walls and ceiling manner in which Scarves Find the most influential in reducing the transmitted energy by 39% in summer and 25% in winter and indicators combined 59% in summer and 38% in winter.***

Keywords: Climatic design, Building envelope, Thermal comfort, Traditional housing, Environmental

1. Introduction

Climate mainly affects the performance of housing and energy consumption. The interior spaces of the house in hot and humid environments strapped noticeable within the thermal comfort, which increases reliance on mechanical energy [1]. Many designers believe that to achieve thermally efficient housing and suitable for the climate greatly affect the aesthetics of the house. This is due to the existence of a gap in the provision of assistance data and parameters of the designer being able to make design decisions that make housing responsive local climate while keeping in shape and system design project. The research aims to provide data derived from comparisons based on detailed accounts of a number of alternatives to the structural design and the variables that contribute to making architectural designs are more adapted to the local climate to reduce energy consumption and costs less. To be close to the limits of thermal comfort has been climatic data for the city of Basra, analysis and conclusion of a study indicators represented by the structural components and indicators to help design and proportion of body mass and trends in housing with some amendments made by the search to match the reality of the Iraqi [2]. The big difference in the degree of day and night temperatures function to choose a high thermal resistance increases the amount of delay time to the heat transfer through the cover of structural materials, housing, modifies or prevents the direct influence of the variables of climate, which made us think about the finding of the building materials used for the walls and ceiling alternatives, Because the roof housing the most vulnerable of solar radiation in summer and in winter the contrary, it has been through the study put forward a new style in the use of lightweight concrete blocks (Althermiston) with I-Section iron or concrete joists prior processing of roof style (jack arching), For the purposes of the present study was to use a single computer energy simulation programs (Ecotect)[3]. And constructing a model Default represents one of the prevailing housing models in the study area. And conduct several tests on the indicators that came out of research to determine the thermal performance and find comparisons and give details of the designer on the degree of influence of all my design index relative to the alternative structural proposal for less convection which requires a minimum of spending on heating and cooling to get to adequate housing for thermal comfort. Down to the conclusions and recommendations given to the impact of each alternative for the purpose of comparison gives sufficient flexibility for the designer to choose the best suited to reduce the variation in the external environment in the internal environment factors.

2. Geographical Characteristics

The city of Basra second , the largest city in Iraq, located far south of Iraq on the West Bank of the Shatt al-Arab, a water crossing, which consists of the confluence of the Tigris and Euphrates rivers and sea port master, an area of19070 Km^2 and is located at Latitude 30^{o}536'N and Longitude 47^{o}815'E and rises 2.4m sea level [4]. Situated where located in the plains of Mesopotamia fertile, they are considered one of the main centers for the cultivation of palm, containing plain areas of sedimentary areas of desert, characterized Basra climate winters and warm spring mild, summer high temperatures much humidity net skies, calm winds and fall moderately.

3. Thermal Comfort

Definition thermal comfort according to the international standard 7730-ISO as a state of mind in which one feels satisfied and activity in the thermal environment Thermal Environment surrounding it, Is determined by the level of comfort range of factors affecting the situation of human physiological space in which they live. The process of determining the ranges of thermal comfort factors are close to humans, such as the same type of activity, clothing and factors directly related to the circumstances surrounding environment, air temperature, relative humidity, air movement or speed, average radiant heat [5]. And away the internal spaces of the houses in the city of Basra, the limits of thermal comfort, and finds that the research into account the limits of the degree of thermal comfort in the design of the external elements of the building in order to thermal protection in the warm period. Figure 1

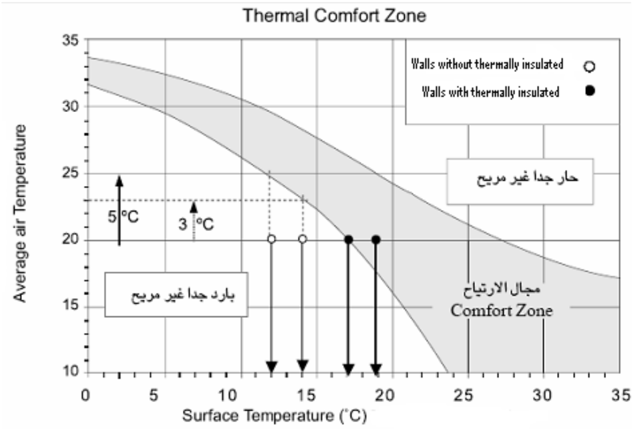

Figure 1: Ranges thermal comfort inside the building and its relationship to a degree heat walls, ceiling and interior air [6]

4. Thermal Performance

The thermal performance is the extent of the design of the building form and elements of climatic conditions changing daily and seasonally in response. The thermal performance efficiency is intended to optimize the relationship between the design of the building thermal performance and between him, and so reduce the energy consumed to enable the building of access to the thermal comfort human [7]. There are a number of factors contribute to the thermal performance of the house is to isolate the materials used for the walls and the ceiling value of the U-value; the more I said this value reduces the energy gained or lost of the house [1]. Many of the problems have emerged in the design of housing in the city of Basra and the most important of which a high degree of internal environment temperature being designed considerations design are not compatible with the natural climatic characteristics of the environment, forgetting the formation of structural mass and building materials and openings. It is important to note that from here to the importance of the following design factors that we consider that the provision of data by the designers will help significantly in making their buildings are approaching the limits of thermal comfort.

4.1 Shape

The shape of the building impact on the amount of energy gained through the building envelope based on geometric elements of the relationship between climate and the shape of the building and, in general, the shape of the effect in reducing and increasing variation in climate factors in the internal environment, The internal temperature is affected directly proportional to the change in the proportion of the external surface area of convection radiation accumulated from building facades, and this change is to form the structural function of the flow rate through the heat [8].

4.2 Orientation

The search for the most efficient thermally geometry must know the most efficient guidance to reduce the exposure of the surfaces of the building of solar radiation [9]. Previous studies have shown it in a completely separate buildings located on the four main axes of elongation and the northern and southern isosceles where less efficient form whenever we moved away from that direction, which is to minimize the effect of solar radiation on the building in summer and increase the use of solar energy in winter, Note that the wind direction movement of the buildings overlooking the relevant causing traffic streets to stir up the dust will not take this research to the receipt of a number of points of modern views on the adoption of windows for air entry, taking into account the appropriate spaces for slots and shaded by umbrellas to book a high solar radiation effective in the sky in summer or increase in winter.

4.3 Ventilation

Natural ventilation is the ventilation of the building with outside air without the use of a mechanical system. It can be achieved with the existence of the openings that fit with the movement of wind and allowing warm in the building at the height of the air and out of the top vents to the outside to be replaced by cool air through the holes in the low-lying areas. These systems can be drawn into the building naturally, but care must be taken to ensure the convenience of users and maintain thermal comfort. The sustainability of the house in a balanced manner [10]. These systems use little energy in the warm months or wet, cooling the most important structure of the building for the most part of the year [11].

4.4 Materials

Traditional houses have characterized the ability of mass of the delay time to move from the temperature of the outside to the inside, with the adoption of the same heat capacity and high materials used to build walls high dense materials bloc such as brick, stone, and the Bishop of the outer surface covered with a layer of dirt. The most important building envelope components are the walls and ceiling and windows that need to be addressed and determine the percentage of the transparent area to the total wall area and the coefficient of heat transfer materials and the extent of absorption and emission of solar radiation falling on the choice of reflective light colored and the type of user Glass. fig. 2 shows a variety of technology and sustainable glass to reduce the force of which the sun heat, such as the color of the glass, double glazing with the flow of air, gases, the waterway that can enhance the thermal and visual comfort. The construction of adequate housing for thermal comfort in Basra and in line with the external environment and dealing with the different chapters efficiently requires taking into account the building envelope materials and promotion of appropriate technologies and reduce the openings and the use of double glazing to contribute to reduce energy.

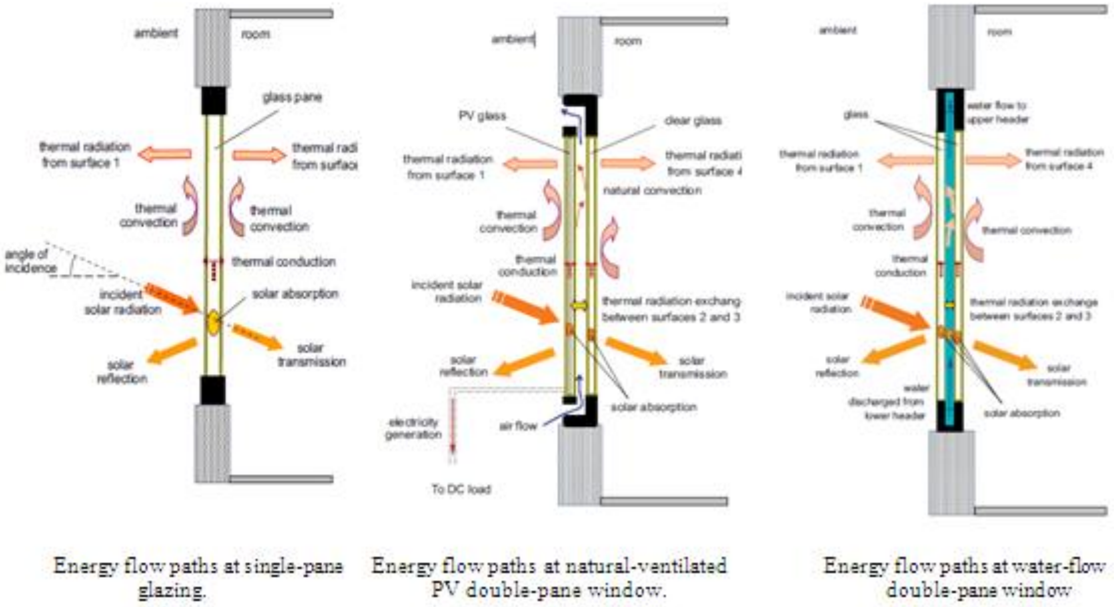

Figure 2: Double glazing sustainable techniques to reduce the natural energy [12]

4.5 Space Size

The increase in high roof space offset by an increase in size, and that any gain thermal means a small increase in the degree of heat because of space spread in the larger space, while at least a size larger difference in temperature appears if the ceiling is lower. The hot-air gathering in the vicinity of the high ceiling layers are far from the level of users, The proportion of ventilation will be reduced when temperatures are abroad are high, and the large size of the air will not spoil quickly, so the identification ceiling height is an important condition that does not interfere with the events and the limits of modern human comfort that we find important factor from a psychological point [13]. The study suggests that increasing the internal space of the house rise will contribute to lowering the temperature due to the increased volume of air moving in the warm period.

5. Study Method

To test the hypothesis and achieve the aim of the research was conducted the following steps:

- Microclimate analysis and identification of indicators according to the determinants schedule Mahoney rate Mahoney.
- Study indicators and building model and simulation Default different situations for a two-day warm extremists of the year for the period 30 July, the cold and the period 30January.
- Analysis of the results and come to conclusions and recommendations.

5.1 Climate city of Basra analysis: analysis climate city of Basra

Basra is located a Latitude 30°536'N and Longitude 47°815'E and rises 2.4 meters above sea level. Advantage of the warm climate in summer and cold winter, large and extremism in temperatures and the high proportion of solar radiation and clear skies, relatively high humidity, dusty winds, the proportion of very low rainfall. To be close to the hot climate tests were conducted in accordance with the schedule after that Mahoney has done research adjustments to match the climate of the city of Basra. Ensure climatic data for the city of Basra (temperature, relative humidity, rain and wind) during the year and determine the highest degree and less degree and then determine the rate during the year, As well as to determine the relative humidity up to the general recommendations and guidelines for the specification and the determinants of the building. It is possible to refer to the source [2] p239-245 to identify the tables and climatic data entry method in detail. Climatic data for the city of Basra readings collected from the General Authority for meteorological. Was reached indicators and some of the recommendations of the house in the city of Basra table 1.

Table 1: Indicators and general and detailed recommendations for the city of Basra [Researcher]

Indicator totals from data sheet				
H1	H2	A1	A2	A3
0	0	9	4	5

Basra, Iraq
Latitude 30°536'N Longitude 47°815'E

General recommendations

Layout

H1	H2	A1	A2	A3		
		0–10			✓	**Orientation north and south (long axis east–west)**
		11–12		5–12		
				0–5	✓	**Compact courtyard planning**

Spacing

H1	H2	A1	A2	A3		
11–12						Open spacing for breeze penetration
2–10						As above, but protection from hot and cold wind
0–1					✓	**Compact layout of estates**

Walls

H1	H2	A1	A2	A3		
		0–2				Light walls, short time-lag
		3–12			✓	**Heavy external and internal walls**

Roofs

H1	H2	A1	A2	A3		
		0–5				Light, insulated roofs
		6–12			✓	**Heavy roofs, over 8h time-lag**

Detailed recommendations

Walls and floors

H1	H2	A1	A2	A3		
		0–2				Light, low thermal capacity
		3–12			✓	**Heavy, over 8h time-lag**

Size of opening

H1	H2	A1	A2	A3		
		0–1		0		Large openings, 40–80%
				1–12		Medium openings, 25–40%
		2–5				
		6–10			✓	**Small openings, 10–25%**
		11–12		0–3		Very small openings, 10–20%
				4–12		Medium openings, 25–40%

5.2 Prevailing Housing

For the purpose of the test design assistance indicators and amendments made by the search for components of building (walls, roof) vents configuration mass and guidance to test one of the main variables of solar radiation and make detailed calculations and compared to thermal loads, requires the identification of local structural components of the house prevailing within the study area in the city of Basra, which represents the base model in the study and comparison, taking advantage of the thermal properties of structural materials in Iraq, the values of the Building Research Center [14] and shown in table.2. Exterior walls 20 mm mortar cement to squirt +200 mm Concrete Block +20 mm plaster whiteness. Total laboratories to the heat transfer to the outer wall U-value =2.39w/m^{2o}C. Either the ceiling consists of materials respectively 40 mm cutting concrete (Steikr) +50 mm clean sand +100 mm the soil clean (Thuar) +20 mm Asphalt or Bitumen layers +150 mm reinforced concrete +20 mm whiteness Plaster shall be U-value = 1.140 w/m^{2o}C.

Most exposed to solar radiation ceiling is and the fact that the roof is used in the city of Basra, currently made of reinforced concrete and has a value of thermal w transmission U-value=1.140 w/m^{2o}C This is a far cry from the desired values identified in the specifications warm w areas U≤ 0.5 w/m^{2o}C. Therefore, the study suggested that the use of porous light concrete blocks (Althermiston) in the ceiling in a way (trimmings) any use light concrete blocks instead of bricks with I-Section iron. Tributary of solid concrete or long pre-processing or arising within the site and are filling the void between each two consecutive tributary using light concrete blocks or slabs Althermiston usual reinforce or blocks, The blocks specially made for this roof, and the percentage of cost reduction up to 25%, which requires reinforced concrete roof and shorten the time required to create a ceiling, which is reflected positively on reducing the period of the establishment of the building, if this method paves the use of prefabricated pieces techniques either Alhorda method is more expensive. Figure 4.

Table 2: Values thermal properties of structural materials in Iraq values [14]

Material	*Thickness m*	*Density kg/m³*	*Thermal Conductivity W/mK*	*Thermal Resistance K/W*
Wall				
Perforated bricks	0.240	1200	0.85	0.730
concrete solid blocks	0.150	1900	1.20	0.250
concrete hollow blocks	0.200	1440	0.90	0.720
Concrete	0.150	2300	1.49	0.101
Stone: limestone	0.300	2600	2.25	0.235
Lightweight concrete Althermiston	0.240	760	0.21	1.127
Two solutions stone	0.400	1680	1.13	0.354
Sino stone (Mosul)	0.040	1900	1.22	0.033
Sinjar stone (White)	0.040	2400	1.96	0.021
Cement mortar	0.020	2050	1.08	0.019
Plaster Normal	0.020	980	0.36	0.056
Light concrete	0.200	1200	0.335	0.270
Surface Finishes				
External rendering	0.020	200	1.40	0.122
Plaster (dense)	0.020	980	0.05	0.056
Plaster (lightweight)	0.020	1200	0.16	0.035
Roofs				
Aerated concrete slab	0.150	500	0.16	0.011
Asphalt 20/30	0.020	1070	0.24	0.084
Felt/Bitumen layers	0.020	1050	0.18	0.060
Screed	0.030	1200	0.41	0.280
Soil Althuar (under flatness)	0.150	1450	0.25	0.650
Tile	0.025	2230	0.93	0.027
Sand	0.050	1690	0.24	0.207
Concrete slabs for flattening	0.040	2240	0.85	0.047
Expanded Polystyrene	0.050	25	0.03	1.661
Glass	0.006	2450	1.08	0.005
Glass wool	0.050	64	0.036	1.389
Floors				
Tiles floor	0.025	2230	0.93	0.027
Plaster mortar(cement)	0.030	2050	1.08	0.028
Concrete	0.100	2300	1.49	0.068
Bricks-squared	0.070	1460	0.54	0.130

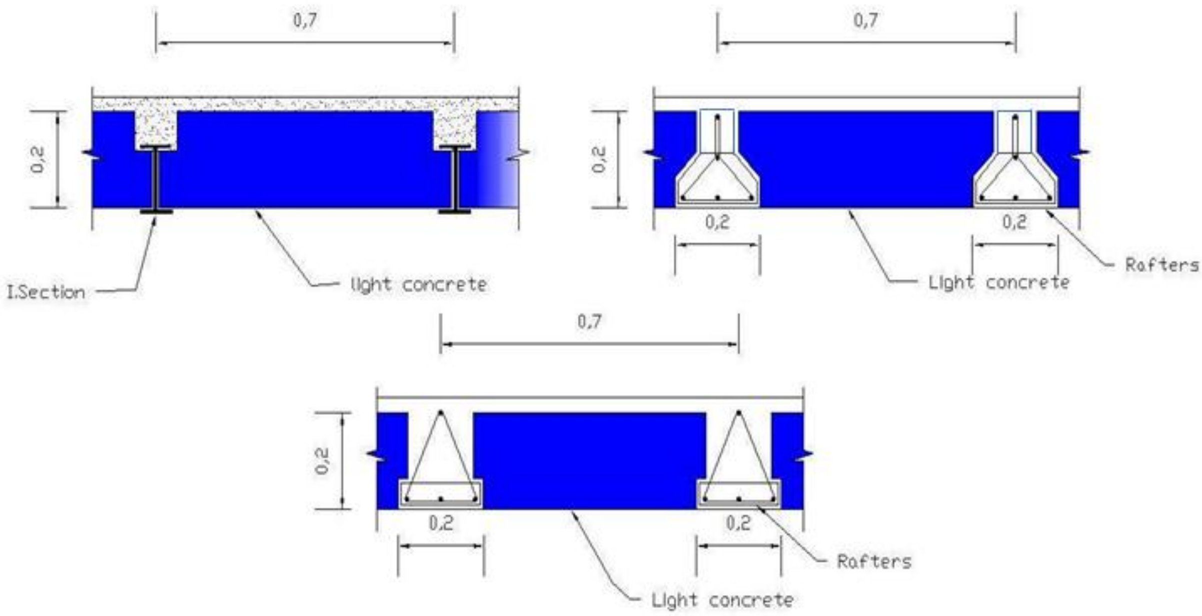

Figure 3: System Ceiling Light concrete block provided by search (Jack arching) [Researcher]

5.3 Model Study

Will be several tests performed on the indicators that came out of the search for a two extremists of the year July 30 in summer and 30 December in winter, to demonstrate the impact on the cooling load by using energy Ecotect simulation program [15], and the use of model of house dwelling Default represents one housing models within the study area in the city of Basra to dimensions 15 m length of the 10m show 3.15 m high with Ground floor. Representing windows 35% of wall space for the foundation of the model fig. 4, and for the other models represent windows 20% of the wall double glazed area and adopted the light colors with high reflectivity of the walls and ceiling appropriate in the tropics, including the white color and to be the simulation as close as possible to reality. Has been selected traditional structural components and the most common in terms of domestic use and beneficiaries of the thermal properties of structural materials in Iraq values to calculate the total energy through the window casing housing shown in table 2. Number of occupants of five people. We expect that we will get some general rules, conclusions and recommendations, and the testing methodology has included indicators:

- Heavy constructivist components of the walls and ceiling and a time lag of limits 8 hours.
- Main directions) northern, eastern, southern, western (and secondary.
- Openings.

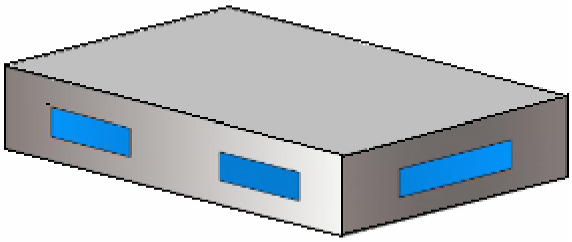

Figure 4: The default model study

5.4 Cases of the Study

The model is run for two days in a year: a typical one day in July 30 (summer) and one day in January 30 (winter). To calculate the thermal performance efficiency and temperature changes, internal loads take into account the heat of five people with no mechanical devices help. Windows closed as normal internal temperature 26°C summer period and 18.5°C winter period. Determine the thermal resistance values of the external surface ***Rso*** under wind bulletin in the study period and using readings of the General Authority for meteorological and seismic monitoring [3], and a number of variables on the constructivist components of the walls and ceiling, table 3.

- As convergence
- Test the effect of combined variables.

Table 3: Case studies and the heat transfer coefficient U-value (w / m^{2o}C) [Researcher]

Element	Layers	Thickens (m)	Attributes U-value w/m^{2o}C	Layers	Thickens (m)	Attributes U-value w/m^{2o}C
Wall W	**Type 1**			**Type 2**		
	• cement • Bricks • Plaster	0.020 0.360 0.020	0.8518	• Bricks Packaging • Glass wool • Bricks • Plaster	0.120 0.050 0.240 0.020	0.3977
	Type 3			**Type 4**		
	• cement • Bricks • Air cap • Bricks • Plaster	0.020 0.240 0.100 0.120 0.020	0.8665	• cement • Light concrete • Plaster	0.020 0.200 0.020	0.8467
Roof R	**Type 1**			**Type 2**		
	• Tile (white) • Plaster mortar • Soil Althuar • Felt/Bitumen layers • Concrete Slab • Plaster	0.025 0.030 0.150 0.020 0.150 0.020	1.0341	• Concrete slabs for flattening • Sand • Soil Althuar • Expanded Polystyrene • Felt/Bitumen layers • Concrete Slab • Plaster	0.040 0.040 0.100 0.050 0.020 0.150 0.020	1.1402
	Type 3			**Type 4**		
	• Tile (white) • Plaster mortar • Light concrete • Soil Althuar • Felt/Bitumen layers • Concrete Slab • Plaster	0.025 0.030 0.150 0.050 0.020 0.150 0.020	0.7923	• Tile (white) • Plaster mortar • Soil Althuar • Expanded Polystyrene • Soil Althuar • Felt/Bitumen layers • Light concrete+ Concrete Slab • Plaster	0.025 0.030 0.100 0.050 0.050 0.020 0.250 0.020	0.2764

5.5 Results

For the purpose of obtaining the results of constructivist components of indicators identified by the research on case studies and design convergence processors that were selected (10) case is the most appropriate of these cases for the purpose of comparison. Energy calculated for one day. When analyzing the results of case studies notes that there is a reduction in the energy Compared paradigm basis table 4.

Warm Period (30 July):

Case1: W1 + R1: the bricks use of a thickness for walls 0.36, roof finish Tile (white) reduced energy by 9.33%.

Case 2: W1 + R2: the bricks use of a thickness for walls 0.36, roof finish the Concrete slabs for flattening and the use of polystyrene thickness 0.050 reduce the amount of energy increased by 10.64%.

Case 3: W1 + R3: the bricks use of a thickness for walls 0.36 roof finish Tile (white) Light concrete blocks (Althermiston) with the use of thickness 0.150 instead of Soil reduce the amount of energy increased by 11.94%.

Case 4: W2 + R2: the use of brick with glass wool for the walls thickness 0.050 roof finish the Concrete slabs and the use of polystyrene thickness 0.050 reduce the amount of energy increased by 16.65%.

Case 5: W2 + R4: the use of brick with glass wool for the walls thickness 0.050 roof finish of concrete and Light concrete blocks (Althermiston) (Horde) thickness 0.250 and the use of polystyrene thickness 0.050 reduce the amount of energy increased by 18.36%.

Case 6: W3 + R3: the use of bricks with air gap thickness 0.050 and an end to the ceiling with Tile (white) use Light concrete blocks thickness 0.150 instead of dust instead of Soil reduce the amount of energy increased by 23.89%.

Case 7: W3 + R4: the use of bricks with air gap thickness 0.050 for the walls and ceiling of concrete and Light concrete blocks (Horde) thickness 0.250 and the use of polystyrene thickness 0.050 reduce the amount of energy increased by 25.66%.

Case 8: W4 + R2: use Light concrete blocks thickness 0.200 to finish the walls and ceiling Concrete slabs for flattening and the use of polystyrene thickness 0.050 reduce the amount of energy increased by 32.66%.

Case 9: W4 + R3: use Light concrete blocks thickness 0.200 to finish the walls and ceiling Tile (white) Light concrete blocks with the use of thickness 0.150 instead of dust Soil reduce the amount of energy increased by 36.13%.

Case 10: W4 + R4: use Light concrete blocks thickness 0.200 for the walls and ceiling of concrete and light concrete blocks (Horde) thickness 0.250 and the use of polystyrene thickness 0.050 reduce the amount of energy increased by 38.70%.

Constructivist components: the energy transmitted index constructivist components has fallen from 9.33% to 38.70%

has been achieved insulating materials largest proportion of reduction in energy from 16.65% to 38.70% achieved insulated ceiling light concrete blocks (Horde Awalakadh Baltrmeston) higher reduction. The guidance indicators, openings, as convergence rates of reduction of 19.22% to 23.34%. Therefore, the constructivist components in the index's biggest percentage reduction compared to the other indices, the use of double-walled insulated brick textured glass wool or air gap decreases from 15.8% to 23.4%, and using the heat insulation of the roof of light concrete blocks and polystyrene down 38.70%. In the case of indicators combined energy has decreased from 32.66% to 59.17%, and indicated in the tables (4-5). What is achieved by the construction of the walls and ceiling Baltrmeston posed search instead of concrete blocks or bricks and roof concrete armed than the speed of construction and ease of configuration and reduce reasonable in cost and the coefficient of thermal U-value=0.41 $w/m^{2o}C$ that is compatible with the requirements of the specifications in the warm areas $U \leq 0.5$ $w/m^{2o}C$. In the case of adding the polystyrene insulating value of heat transfer coefficient decreases to $0.2764 w/m^{2o}C$, the choice of a low thermal coefficient of materials and high thermal capacity and time delay of more than 8 hours will contribute to improve the thermal comfort of the home. Reduce heat transfer to the walls of the foundation of the model of $w/m^{2o}C$ 2.941 to $0.397 w/m^{2o}C$ coefficient and the roof 1.140 $w/m^{2o}C$ to $0.276 w/m^{2o}C$, Offset by a decrease in the energy of the summer 6842.44w to 4193.592 w rate reduction of 9.33% to 38.70% as it provides a thermal gradient difference in the amount of 21°C

- Orientation: South orientation reduction in power limits 3.50%.
- Orientation northern reduction in energy limits 5.10%.
- Orientation eastern increase in power limits 2.50%.
- Orientation western increase in power limits 6.20%.
- Openings: reducing the proportion of openings from 35% to 20% of the wall space with the use of double glazing up the discount rate from 7.10% to 14.00%, according to the slots site.
- A stake as convergence and one reduction rate of 11.71% to 16.38%.
- Courtyard: The presence of the courtyard of which depends on the determinants of the courtyard patio area site nature and the high walls surrounding the courtyard and the greater the proportion of height of the building said the sun penetrating to the level of the land yard rays. This increases the shaded area and reduces air temperatures during the day.

The fact that the model study floor by one ratio of reduction of up to 6%. So the inner courtyard roof glass roof is covered with solar surge oblique directed towards the south. To this surge allow sunlight enter winter and prevent them in the summer. Search conducted a test to increase the volume of space Increased internal space rising to 3.20 pm instead of 2.80 m will reduce the internal temperature to 1.5o, The increase in internal space height contributed to lowering the temperature warm for the period due to increased mobile air volume, either colors have been used reflective colors (Very Conqueror) Wallpaper, although the phenomenon is prevalent in buildings using warm colors, so has done research colors test shoved get results positive change in the external interface colors for the walls and floor of the roof up to 3% of the colors white light and yellow.

Table 4: penetrating power on 30July [Researcher]

Description		Changes in structural elements		Different indicators				
		Energy (w)	**Energy% Reduced**	**Orientation**	**Planned compact** one wall	**Openings** 20% (double glazing)	**Energy (w)**	**Energy% Reduced**
1	W1+ R1	6203.971	9.33%	6079.905	5477.031	5458.840	4607.833	23.33%
2	W1+ R2	6114.256	10.64%	5991.970	5483.811	5469.321	4716.590	20.43%
3	W1+ R3	6025.352	11.94%	5904.844	5331.852	5302.921	4488.945	22.46%
4	W2+ R2	5702.768	16.65%	5588.712	5049.813	5018.528	4251.517	21.22%
5	W2+ R4	5586.105	18.36%	5474.382	4998.318	4915.772	4216.262	20.03%
6	W3+ R3	5207.263	23.89%	5103.117	4495.548	4426.173	3610.312	23.34%
7	W3+ R4	5086.018	25.66%	4984.297	4401.587	4323.118	3536.966	22.65%
8	W4+ R2	4607.571	32.66%	4515.419	3805.816	3962.511	3068.604	22.50%
9	W4+ R3	4369.910	36.13%	4281.709	3799.635	3713.741	3055.265	19.22%
10	W4+ R4	4193.592	38.70%	4109.710	3506.871	3564.544	2793.941	20.47%

Table 5: Their discount energy ratios 30 January indicators combined [Researcher]

	Energy reduced (%) of the combined indicators			
Description	**Cases**	**Energy**	**%Energy**	**%Energy Reduced**
- Base case	Base case	6842.44	100.00	0.00
-Bricks / Tile (white)	Case 1	4607.833	67.34	32.66
-Bricks / Expanded Polystyrene	Case 2	4716.590	68.93	31.07
-Bricks / Tile (white) + Insulated Light concrete	Case 3	4488.945	65.60	34.40
-Insulated Glass wool / Expanded Polystyrene	Case 4	4251.517	62.13	37.87
-Insulated Glass wool / Expanded Polystyrene + Insulated (Light concrete+ Concrete Slab)	Case 5	4216.262	61.61	38.39
- dble walls +Air cap / Insulated Light concrete	Case 6	3610.312	52.76	47.23
- dble walls +Air cap / Expanded Polystyrene + Insulated(Light concrete+ Concrete Slab)	Case 7	3536.966	51.69	48.31
-Insulated Light concrete / Expanded Polystyrene	Case 8	3068.604	44.84	55.16
- Insulated Light concrete / Insulated Light concrete	Case 9	3055.265	44.65	55.35
-Insulated Light concrete / Expanded Polystyrene + Insulated (Light concrete+ Concrete Slab)	Case 10	2793.941	40.83	59.17

Cold period (30 Januarya

Lost energy index structural components have achieved the highest percentage reduction in the use of insulating materials, roof insulation and exterior walls, as in the cases (5-10), the amount of energy decreased to 25.29%. Change the orientation of the building did not give an important Indicator of the lead did not exceed 2.81%. Reducing the proportion of openings from 35% to 20% of the wall space with the use of double glazing up the discount rate from 4.65% to 6.80%, according to the slots site. As a stake as convergence single discount rate of 6.86% to 8.00%. In the case of combined indicators, the reduction rate of 14.30% to 37.78%. tables 6-7. fig 5-6 energy transition temperatures and internal models to study shows.

Table 6: The lost energy on 30January [Researcher]

Description		Changes in structural elements		Different indicators				
		Energy (w)	**Energy% Reduced**	**Orientation**	**Planned compact** one wall	**Openings** 20% (double glazing)	**Energy (w)**	**Energy% Reduced**
1	W1+ R1	977.852	0.23%	952.554	910.728	932.367	839,93	14.10%
2	W1+ R2	968.239	1.20%	950.294	902.813	920.516	837.14	13.52%
3	W1+ R3	931.726	5.38%	922.011	879.537	889.154	827.25	11.21%
4	W2+ R2	923.895	5.73%	896.557	860.258	877.506	787.53	14.75%
5	W2+ R4	905.715	7.59%	881.060	863.832	863.444	796.90	12.01%
6	W3+ R3	870..911	11.14%	851.372	811.457	832.220	735.22	13.51%
7	W3+ R4	841.816	14.11%	819.979	785.176	803.635	725.15	13.85%
8	W4+ R2	804.196	17.94%	788.452	744.816	761.477	686.32	14.65%
9	W4+ R3	771.259	21.30%	750.871	717.686	739.332	663.37	13.98%
1	W4+ R4	732.173	25.29%	711.550	673.532	689.056	609.79	16.71%

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Table 7: Their discount energy ratios 30 January indicators combined [Researcher]

	Energy reduced (%) of the combined indicators			
Description	**Cases**	**Energy**	**%Energy**	**%Energy Reduced**
- Base case	Base case	980.110	100.00	0.00
-Bricks / Tile (white)	Case 1	839,931	-85.696	14.30
-Bricks / Expanded Polystyrene	Case 2	837.145	-85.413	14.58
-Bricks / Tile (white) + Insulated Light concrete	Case 3	827.250	-84.40	15.59
-Insulated Glass wool / Expanded Polystyrene	Case 4	787.531	-80.351	19.64
-Insulated Glass wool / Expanded Polystyrene + Insulated (Light concrete+ Concrete Slab)	Case 5	796.906	-81.307	18.69
- dble walls +Air cap / Insulated Light concrete	Case 6	735.227	-75.014	24.98
- dble walls +Air cap / Expanded Polystyrene + Insulated(Light concrete+ Concrete Slab)	Case 7	725.158	-73.987	26.01
-Insulated Light concrete / Expanded Polystyrene	Case 8	686.323	-70.025	29.97
-Insulated Light concrete / Insulated Light concrete	Case 9	663.371	-67.683	32.31
-Insulated Light concrete / Expanded Polystyrene + Insulated (Light concrete+ Concrete Slab)	Case 10	609.792	-62.216	37.78

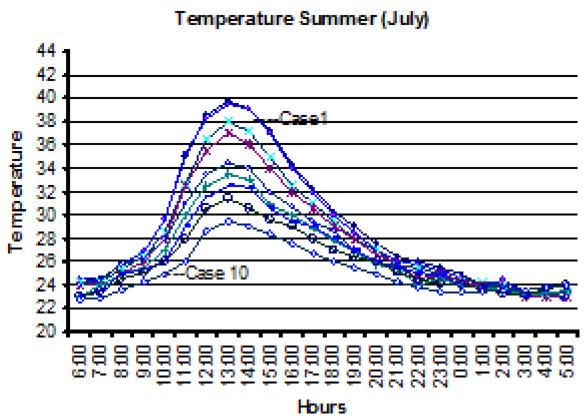

Figure 5: Temperatures internal models to study (July)

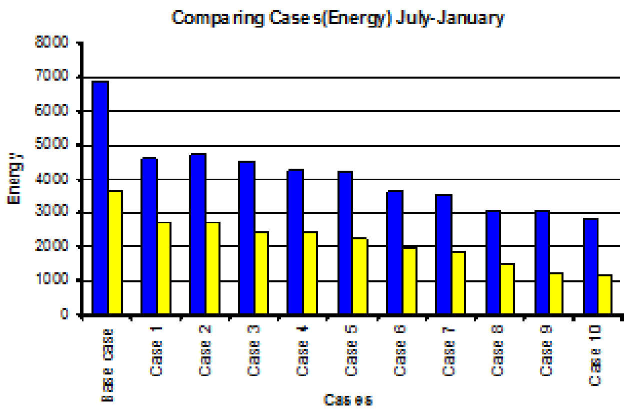

Figure 6: Energy transmitted cases of study (July- January)

Dependence on the results of the study were to determine the curve helps the designer to identify the thermal acquisition of roof and wall dependent on the surface area shown in Figure (8), the designer can after the surface area of the house account which was designed to extract energy received for the roof and the wall and compared with the permissible limits (to be determined The amount of energy permitted by the proposed energy curve of the roof and the wall being less heat gain), and when you do not match the design efficiency, the designer needs to make some processors physical components of the characteristics of the elements in terms of a change in the thermal properties of materials consisting U-value to improve the design, so the **boundaries of design flexibility are recommendations for climate progress to the designer to help him achieve the desired thermal efficiency of the house level.**

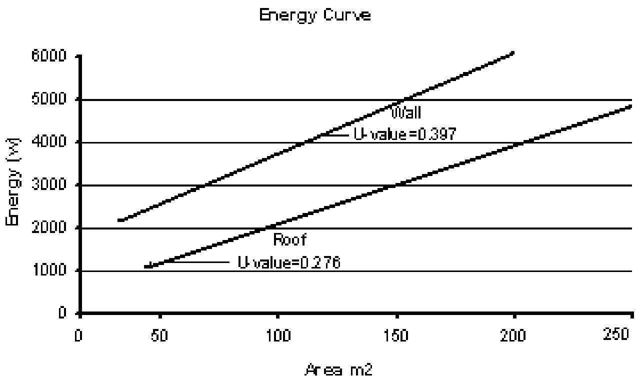

Figure 7: Received accredited energy curve as ceiling and wall space [Researcher]

6. Conclusions

1) Use Light concrete blocks for the walls and ceiling style (trimmings) Light concrete blocks with I-Section iron or joists concrete pre-processing will reduce the transmitted energy and provides more than 60% of energy consumption, as well as the construction speed and brevity of materials, labor and reflected positively on the total cost (the cost of construction and operating) thereby reducing the cost to the citizen and the state, it also lends itself to control designed to change the form of housing and guidance in order to achieve as much of the design requirements.
2) Orientation north and south (longitudinal axis of the East-West) and choose the appropriate location of the windows is the most important dismiss with openings in the western facade as possible.
3) As convergence with the adjacent housing reduces exposed to external conditions of the area and contributes to increase the thermal efficiency of the house.
4) Roofing courtyard covered with a moving roof using a barrier sun slanting oriented towards the south to allow sunlight enter in winter and in summer and prevent it allow the passage of air through it.

5) Increase ceiling height helps lower the temperature within the presence of people.
6) The presence of plants such as palm trees more than shaded areas of the walls and ceiling and contribute to air around about housing and working battering ram to dust and dir**t**.

7. Recommendations

Recommendation of isolating walls of the housing list by adding heat insulation of polystyrene and a thickness of 6 cm from the outside of the wall to become housing compatible with the specifications for the tropics.

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